(12) UK Patent Application (19) GB (11) 2 133 073 A

(21) Application No 8400534
(22) Date of filing 10 Jan 1984
(30) Priority data
(31) 3300732
(32) 12 Jan 1983
(33) Fed. Rep. of Germany (DE)
(43) Application published
18 Jul 1984
(51) INT CL³
E05B 47/00
(52) Domestic classification
E2A 431 PE
(56) Documents cited
None
(58) Field of search
E2A
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(54) A central locking system for a motor vehicle

(57) The system has an electronic receiver/controller and a remote actuator/transmitter incorporating an encoder having a set of different codewords corresponding to the unlocking signal, sequenced in cyclic order (1, 2, . . . *x*, . . .*n*). At each actuation, one of these codewords is transmitted, in sequence, the *x*-th actuation transmitting the *x*-th codeword. The receiver has a decoder, which counts the transmissions and only converts the *x*-th transmission into the unlocking signal, releasing the electronic controller if it is the *x*-th codeword, these cycles continuing until $x=n$ and then returning to $x=1$ and recommencing. If synchronism between the encoder and decoder is disturbed, it is restored by a signal from an auxiliary encoder having a set (*m*) of different, auxiliary, sequenced codewords acting as synchronisation signals. When the transmitter is specially actuated, one of these auxiliary codewords is transmitted, in sequence, the *x*-th actuation generating the *x*-th auxiliary codeword. An auxiliary decoder in the receiver counts the transmissions and converts the *x*-th auxiliary codeword on receipt into the unlocking signal, bringing about synchronisation and also switching the receiver to the $(x+1)$th auxiliary codeword (which the transmitter is prepared to emit), until at $x=m$ the cycle recommences at 1.

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SPECIFICATION

A central locking system for a motor vehicle

This invention relates to a central locking system for a motor vehicle, having an electronic controller and a remote actuator, in which the remote actuator has at least one transmitter functioning as a key and a receiver functioning as a lock, the transmitter emits a signal, on actuation, which has the purpose of releasing the centrally locked motor vehicle locks, and the receiver supplies one or more electrical pulses to the electronic controller of the central locking system. In order to prevent the unauthorised interception of signals passed between the transmitter and the receiver, and their direct use as picklock to release the central locking system, use is made of the means developed in data procesing technology for the securing and subsequent releasing of signals. To this end, the transmitter incorporates a coding device having a plurality (n) of different codewords corresponding to the unlocking signal in conformity with a prescribed code, the codewords being sequenced in cyclic order ($1, 2, \ldots x, \ldots n$). Each time the transmitter is actuated, one of these codewords is transmitted, in sequence so that the x-th actuation transmits the x-th codeword. The receiver has a decoding device corresponding to the coding device, which counts the transmissions and only converts the x-th transmission into the unlocking signal, thereby releasing the electronic controller, if the codeword received is in fact the x-th codeword, these cycles continuing until $x=n$ and then returning to $x=1$. This system works provided synchronism is maintained between the coding device and the decoding device. It can be disturbed by incorrectly actuating the transmitter. Synchronism between the coding device and the decoding device can be re-established after failure by providing the transmitter with an additional auxiliary coding device, which when specially actuated generates auxiliary codewords not contained in the set (n) of different codewords, while the receiver has an auxiliary decoding device which converts an auxiliary codeword on receipt into the unlocking signal, provided that the decoding device previously set by the receipt of an x-th codeword has received a y-th codeword (x being different from y), this releasing process also resetting both the coding device and the decoding device to a common starting codeword in the counting cycle ($1, 2, \ldots x, \ldots n$). The entire system has proved intrinsically sound, and makes it highly improbable in the mathematical sense that a picklock can be produced by intercepting and recording signals emitted by the key or transmitter.

However, the object of the invention is to further modify and improve the central locking system described above, so that it is even more difficult to produce an unauthorised picklock by recording signals passed between the transmitter and the receiver.

According to the present invention, therefore, the auxiliary coding device has a set (m) of different auxiliary codewords acting as synchronising signals in conformity with a prescribed auxiliary code and sequenced in cyclic order ($1, 2, \ldots x, \ldots n$), special actuation of the transmitter generating one of these auxiliary codewords in sequence so that the x-th actuation generates the x-th auxiliary codeword, while the auxiliary decoding device counts the transmissions and, on the one hand, converts the received auxiliary codeword into the unlocking signal provided it is the x-th auxiliary codeword received at the x-th actuation, and on the other hand, having brought about synchronisation as already described, switches the receiver to respond to the $(x+1)$th auxiliary codeword (which the transmitter is prepared to emit), and so on until after $x=m$ the cycle recommences at 1. According to the invention, the auxiliary codeword in force is also taken from a set of codewords specially reserved for synchronisation and sequenced in cyclic order as described. This set (m) is traversed in steps, so that the synchronisation signal is additionally changed continuously. Each time the transmitter is specially actuated, the auxiliary codeword moves one forward. The receiver also moves one forward on receipt of an auxiliary codeword, provided it is that auxiliary codeword which it should next receive in the cyclic order. It is obvious that under the system of the invention the auxiliary coding device and the auxiliary decoding device must be synchronised. If synchronism should be lost, it is preferred under the invention for the receiver to switch back to a state of readiness to receive the first auxiliary codeword in the set after receiving at least one selected auxiliary codeword from the set (m), the transmitter being adapted to return to the same first auxiliary codeword after unusual special actuation, for example unusually long or frequent special actuation. The transmitter preferably has an attachment which reduces the output power and can be brought into use by specific special actuation, the output power being reduced to a sufficient extent to exclude any unobserved and unauthorised recording of the auxiliary codewords. The output power can be so low that the transmitter must as it were be pressed against the window of the motor vehicle equipped with the central locking system of the invention, assuming that the receiving antennae are mounted in the window concerned.

Claims

1. A central locking system for a motor vehicle having an electronic controller and a remote actuator, in which the remote actuator has at least one transmitter functioning as a key and a receiver functioning as a lock, the transmitter emits a signal, on actuation, which has the purpose of releasing the centrally locked motor vehicle locks, and the receiver supplies one or more electrical pulses to the electronic controller of the central locking system, the transmitter

incorporating a coding device having a plurality (n) of different codewords corresponding to the unlocking signal in conformity with a prescribed code and the codewords being sequenced in cyclic order (1, 2, . . . x . . . n), so that each time the transmitter is actuated one of these codewords is transmitted in such a sequence that the x-th actuation transmits the x-th codeword, and the receiver having a decoding device corresponding to the coding device, which counts the transmissions and only converts the x-th transmission into the unlocking signal, thereby releasing the electronic controller, if the codeword received is in fact the x-th codeword, these cycles continuing until $x=n$ and then returning to $x=1$, synchronism between the coding device and the decoding device being re-established after failure by providing the transmitter with an additional auxiliary coding device, which when specially actuated generates auxiliary code-words not contained in the set (n) of different codewords, while the receiver has an auxiliary decoding device which converts an auxiliary codeword on receipt into the unlocking signal, provided that the decoding device previously set by the receipt of an x-th codeword has received a y-th codeword (x being different from y), and finally this releasing process also resetting both the coding device and the decoding device to a common starting codeword in the counting cycle (1, 2, . . x, . . . n), the auxiliary coding device having a set (m) of different auxiliary codewords acting as synchronising signals in conformity with a prescribed auxiliary code and sequenced in cyclic order (1, 2, . . . x, . . . n), special actuations of the transmitter generating one of these auxiliary codewords in sequence so that the x-th actuation generates the x-th auxiliary codeword, while the auxiliary decoding device counts the transmissions and, on the one hand, converts the received auxiliary codeword into the unlocking signal provided it is the x-th auxiliary codeword received at the x-th actuation, and on the other hand, having brought about synchronisation as already described, switches the receiver to respond to the $(x+1)$th auxiliary codeword (which the transmitter is prepared to emit), and so on until after $x=m$ the cycle recommences at 1.

2. A central locking system as in Claim 1, wherein if synchronism is lost between the auxiliary coding device and the auxiliary decoding device, the receiver switches back to a state of readiness to receive the first auxiliary codeword in the set after receiving at least one selected auxiliary codeword from the set (m), the transmitter being adapted to return to the same first auxiliary codeword after unusual special actuation, for example unusually long or frequent special actuation.

3. A central locking system as in Claim 2, wherein the transmitter has an attachment which reduces the output power and can be brought into use by specific special actuation.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1984. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.